

New claims

1. Hydraulic steering system (100) for a vehicle, in particular for a mobile machine, having at least two steering cylinders (1, 2), in which cylinder pistons (3, 4) are displaceable, the position and/or direction of motion of which in the steering cylinders (1, 2) fix the steering angle and/or steering direction of steerable vehicle wheels relative to a body (5) of the vehicle, wherein each of the displaceable cylinder pistons (3, 4) divides the associated steering cylinder (1, 2) into in each case two pressure chambers (6 and 7, 8 and 9), and having an, in terms of the volumetric displacement, variable first hydraulic pump (14), the first port (46) of which is connected, depending on the steering direction to one of the pressure chambers (6, 7) of the first steering cylinder (1) and to one of the pressure chambers (8, 9) of the second steering cylinder (2),
characterized in
that the second port (15) of the variable first hydraulic pump (14) is connected in a closed circuit to the other pressure chamber (6, 7) of the first steering cylinder (1) and to the other pressure chamber (8, 9) of the second steering cylinder (2).
2. Hydraulic steering system according to claim 1,
characterized in
that in each case a first pressure chamber (7; 9) adjoins the associated cylinder piston (3; 4) with a pressurization area (A1) that is smaller than the pressurization area (A2), with which the in each case

other second pressure chamber (6; 8) adjoins the corresponding cylinder piston (3; 4), and that each port (46; 15) of the hydraulic pump (14) is connected to a first pressure chamber (7; 9) with a smaller pressurization area (A1) and to a second pressure chamber (8; 6) with a larger pressurization area (A2).

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3. Hydraulic steering system according to claim 1 or 2,
10 **characterized in**
that the delivery direction of the hydraulic pump (14) operating in two-quadrant mode fixes the steering direction.
- 15 4. Hydraulic steering system according to claim 3,
characterized in
that the pressure medium volume delivered at the first port (46) and/or at the second port (15) of the hydraulic pump (14) operating in two-quadrant mode
20 fixes the steering angle.
5. Hydraulic steering system according to claim 4,
characterized in
that setting of the swivelling direction of the
25 hydraulic pump (14) and of the pressure medium volume delivered at the first port (46) and at the second port (15) of the hydraulic pump (14) is effected in dependence upon a deflection set at a first steering organ (43) designed in the style of a steering wheel
30 and/or at a second steering organ (44) designed in the style of a joystick.

6. Hydraulic steering system according to claim 5,
characterized in
that in dependence upon the deflection of the first
and/or second steering organ (43, 44) an adjusting
5 valve (35) is activated.
7. Hydraulic steering system according to claim 6,
characterized in
that the deflection of the adjusting valve (35) is
10 effected by means of electric actuating solenoids at
control ports (40, 41), which receive from the first
and/or second steering organ (43, 44) in each case an
electrical adjusting signal, which is generated by an
electrical transducer (42, 64) and corresponds to the
15 deflection of the first or second steering organ (43,
44).
8. Hydraulic steering system according to claim 7,
characterized in
20 that the deflection of the adjusting valve (35) is
effected by means of the adjusting pressures that act
in the control chambers situated at the two control
ports (40, 41) and correspond to the deflection of the
first or second steering organ (43, 44).
25
9. Hydraulic steering system according to claim 8,
characterized in
that at the first and second port (51, 55) of a
variable second hydraulic pump (52) adjusting pressures
30 arise, which correspond to the deflection of the first
steering organ (43).

10. Hydraulic steering system according to claim 8 or 9,
characterized in
that in a pilot unit (54) two pressure reduction valves
(62, 63), the inputs of which are connected in each
5 case to the high-pressure port (19) of a feed pump (17)
and to a hydraulic tank (61), generate the adjusting
pressures corresponding to the deflection of the second
steering organ (44).
- 10 11. Hydraulic steering system according to one of claims 1
to 10,
characterized in
that the adjusting valve (35) is a 4/3-way valve,
wherein the first input port (67) thereof is connected
15 to the high-pressure port (19) of a feed pump (17), the
second input port (68) thereof is connected to a
hydraulic tank (39), the first output port (65) thereof
is connected to a first adjusting pressure chamber (32)
of a variation device (30) and the second output port
20 (66) thereof is connected to a second adjusting
pressure chamber (33) of the variation device (30).
12. Hydraulic steering system according to claim 11,
characterized in
25 that the variation of the first hydraulic pump (14) in
terms of the swivelling direction and the pressure
medium volume delivered at its first port (46) and the
pressure medium volume delivered at its second port
(15) is effected by means of the variation device (30).
30
13. Hydraulic steering system according to claim 11 or 12,
characterized in

that the first hydraulic pump (14) and the feed pump (17) are driven via a common drive shaft (16) by a mobile machine, in particular by a diesel-driven generating set.

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14. Hydraulic steering system according to one of claims 11 to 13,

characterized in

10 that a low-pressure port (18) of the feed pump (17) is connected by a filter (20) to a hydraulic tank (21), and the high-pressure port (19) of the feed pump (17) is connected in each case by a non-return valve (21, 22) to a first hydraulic load line (12), which is connected to the first port (46) of the first hydraulic pump (14), and to a second hydraulic load line (13),
15 which is connected to the second port (15) of the first hydraulic pump (14).

15. Hydraulic steering system according to claim 14,

20 **characterized in**

that in the first and second hydraulic load lines (12, 13) in each case a non-return valve (47, 48) is provided.

- 25 16. Hydraulic steering system according to one of claims 1 to 15,

characterized in

30 that with regard to their adjusting piston rods the steering cylinders (1, 2) are oriented relative to one another at an angle α of up to max. 90° .

Translator's note

In claim 13 the hydraulic pump is driven by an "Arbeitsmaschine" (mobile machine) but on page 7, line 10 of the description it is driven by an "Antriebsmaschine" (prime mover); a possible error here?

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Translator's notesDescription

Page 1, line 23: "deren Position" - as the pronoun refers to the singular noun "Stellkolben", should "deren" not be "dessen"?

Page 5, lines 12-14: "die beiden Stelldruckkammern ... beaufschlagt wird" - plural subject, singular verb.

Page 6, line 34: "kolbenstangeneitigen" should be "kolbenstangenseitigen".

Page 6, line 36: "kolbenseitige Stelldruckkammer 7" (piston-side) should be "kolbenstangenseitige" (piston-rod-side). Not changed.

Page 9, line 34: "Schwenkschreibe" - this is assumed to be a typo for "Schwenkscheibe" (swash plate).

Page 10, line 11: "Stellventils 31" - 31 should be 35. Not changed.

Page 14, line 26: "Druckminderventile 60 und 63" (pressure reduction valves 60 and 63) - 60 should be 62. Not changed.

Claims

In claim 11 (original set of claims) the number "1" is missing after "Ansprüche" but this is corrected in the new set of German claims. Not changed in the translation of the original claims.

In claim 13 (both sets of claims) the hydraulic pump is driven by an "Arbeitsmaschine" (mobile machine) but on page 7, line 10 of the description it is driven by an "Antriebsmaschine" (prime mover); a possible error here?